

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 October 2001 (11.10.2001)

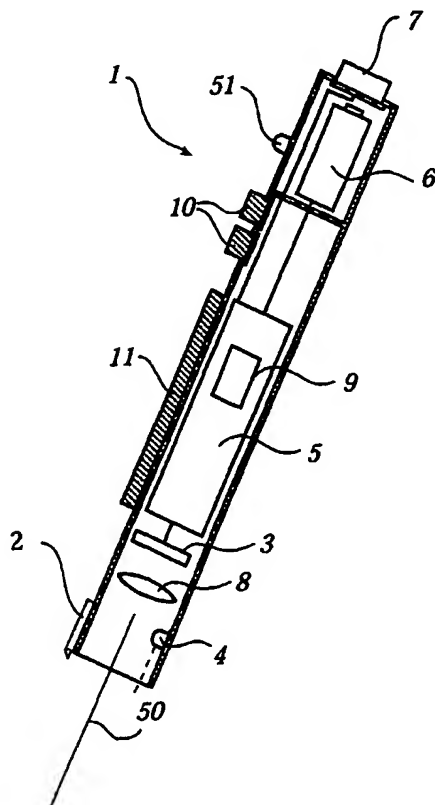
PCT

(10) International Publication Number
WO 01/74598 A1

- (51) International Patent Classification⁷: **B41J 3/36 //** 2/00, H04N 1/00
- (21) International Application Number: **PCT/SE01/00595**
- (22) International Filing Date: 21 March 2001 (21.03.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
0001245-0 5 April 2000 (05.04.2000) SE
- (71) Applicant (for all designated States except US): **ANOTO AB** [SE/SE]; c/o C Technologies AB, Scheelevägen 15, S-223 70 Lund (SE).
- (72) Inventors; and
(75) Inventors/Applicants (for US only): **ERICSON, Petter** [SE/SE]; Industrigatan 2 B, S-212 14 Malmö (SE). **BURSTRÖM, Stefan** [SE/SE]; Kämnråstråten 8:B201, S-226 45 Lund (SE).
- (74) Agent: **AWAPATENT AB**; Box 5117, S-200 71 Malmö (SE).
- (81) Designated States (national): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

[Continued on next page]

(54) Title: **PRINTER**



(57) Abstract: A printer (1) comprises a nozzle (2) for dispensing dye on a surface. The printer (1) also comprises an image sensor (3) for recording an image (16) of the surface, the printer (1) being adapted to print on the surface with the aid of the recorded image (16). The printer is adapted to convert the recorded image into at least one recorded position in the form of two coordinates, in response to the recorded image containing a position-coding pattern (13) coding at least one position.

WO 01/74598 A1



(84) **Designated States (regional):** ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PRINTERField of the Invention

The present invention relates to a printer for dispensing dye on a surface.

Background of the Invention

5 The use of computers continuously increases in society. Computers have significantly facilitated the processing of information. Although computers can present information on displays, there is a need for printing information on paper. Generally computers are connected to a printer in a network.

10 The use of portable computers increases more and more. To benefit maximally by the fact that they are portable, they must be connected to a portable printer. There are a large number of printers on the market which
15 operate according to a number of different principles. Essentially two kinds of printer are presently used, viz. laser printers and inkjet printers. Laser printers are based on parts of a sheet of paper being charged with static electricity. On the charged parts of the sheet,
20 toner is applied which adheres owing to the static electricity. Then the toner is made to stick to the sheet by burning. Inkjet printers operate in such manner that the sheet of paper is made to pass an inkjet head which is adapted to move back and forth perpendicular to the plane
25 of the sheet. The inkjet head sprays ink according to a pattern which is stored in digital form. A common feature of both types of printer is that they are relatively bulky and thus inconvenient to carry along.

30 The United States patent 5,927,872 describes a system and a method of printing an image on a paper using a handheld printer. The printer detects its change in position by comparing successively registered images of the surface of the paper. A user marks the position where

the image is to be printed and moves the printer over the paper in order to print the image. The relative positions of a number of different images depends on the position where the user initialise the printing. If the user lifts
5 the printer during printing it may be difficult for the printer to continue printing at the correct position.

There is thus a need for a new kind of compact printer which can easily be carried by a user and which can resume the printing process after an interrupt.

10 Summary of the Invention

An object of the present invention is to provide a small and compact printer.

A further object of the present invention is to provide a printer which need not be in contact with the
15 edges of the base on which printing is carried out.

One more object of the present invention is to provide a printer which can be used to print on the surface of a base of arbitrary shape.

Another object of the present invention is to provide a method for printing information on the surface of
20 a base of arbitrary shape.

Still a further object of the present invention is to provide a printer which can resume the printing process after an interrupt.

25 A basic concept of the present invention is to use information on the surface of the base, on which surface information is to be printed, to decide whether printing is to occur.

A printer according to one aspect of the present
30 invention comprises means for printing on a surface and an image sensor for recording an image of the surface, said printer being adapted to print on the surface with the aid of the recorded image and graphic information that is to be printed. The printer is adapted to convert
35 the recorded image into at least one recorded position in the form of two coordinates, in response to the recorded image containing a position-coding pattern coding at

least one position.

The printing may be performed with various means such as, e.g. a ballpoint dispensing ink, a point which burns the surface to be printed, a point which applies a pressure to the surface, thereby blackening the surface.

A printer according to another aspect of the invention comprises a nozzle for dispensing dye on a surface. The printer is characterised in that the printer is adapted to dispense dye on the surface with the aid of the recorded position.

As the printer determines its position from the surface the printing may be resumed at the correct position after an interrupt.

By dispensing is here meant that the dye is dispensed from the nozzle. According to this aspect the printing means is a nozzle.

According to an embodiment of the invention, the nozzle is a conventional inkjet head.

The dye is preferably dissolved in a liquid, but within the scope of the invention the dye can also be pulverulent.

Preferably the dye is ordinary ink, but it can also be some other suitable dye.

By the printer being adapted to record an image of the surface and printing with the aid of information in the recorded image, the printer need not detect the outer edges of the sheet of paper, which is the case in conventional printers which make use of direct or indirect knowledge of the location of the sheet in the printing operation. This means that the printer can be made extremely small.

Preferably, the printer also comprises a memory for storing graphic information in the form of a plurality of graphics positions.

By graphic information is here meant images or text that can be printed on a surface.

According to a less preferred embodiment, the

printer communicates with an exterior memory containing the graphic information.

The printer is advantageously adapted to convert text and images that are to be printed, into said plurality of graphics positions. As a result, information that is to be printed using the printer can be entered as text. It is graphic information that is printed using the printer.

The printer is advantageously adapted to convert the recorded image into at least one recorded position in the form of two coordinates, in response to the recorded image containing a position-coding pattern which codes at least one position.

By adapting the printer to determine a recorded position starting from a position-coding pattern, it can easily determine its position. When moving the printing means and the image sensor over the surface, an image corresponding to the graphic information will thus gradually develop.

According to a less preferred embodiment, the printer can determine relative movements by comparing different images with each other. With the aid of recorded images, the printer can decide how much it has been moved by putting together recorded images and thus printing so that the graphic information is printed. However, this is considerably more complicated.

The printer is advantageously adapted to transform the graphics positions in the graphic information in response to an input signal containing information about how the graphics positions are to be transformed.

The graphics positions can then be printed on a base with a position-coding pattern which codes arbitrary positions by the graphics positions being transformed to graphics positions which conform with positions coded by the position-coding pattern.

The transformation is preferably carried out with the aid of said at least one recorded position as input

signal, so that one of the graphics positions essentially conforms with a position in the position-coding pattern.

This means that a printer automatically transforms the graphics positions with the aid of the position-coding pattern. For instance, the graphics positions are transformed so that the median of the different graphics positions will be in the recorded position which is recorded first.

The printer is preferably adapted to determine a predicted position of the printing means by means of the recorded position and to print when the predicted position conforms with a graphics position in the graphic information.

The predicted position is a position in which the printing means is expected to be located on a subsequent occasion when the printing occurs. Owing to the fact that it takes time to process a recorded image and since it takes a certain time from a signal being emitted that the printing is to occur until the printing actually occurs, the predicted position is not the same as the recorded one.

When the recorded position is the correct position the printing thus occurs. By moving the printing means and the image sensor over all positions on the surface of a base, all the graphic information is printed, provided that the position-coding pattern codes all graphics positions in the graphic information.

According to a less preferred embodiment, the printer is adapted to print on the surface when the recorded position conforms with a graphics position in the graphic information. This requires that the image-processing be quick or that the printer be moved slowly. If the dye is dispensed without a predicted position being calculated, the possible resolution of the printed image is deteriorated since a certain displacement will arise between the graphics position and the position in which the dye is dispensed. The displacement depends on the

image-processing speed and the speed of the nozzle.

The position-coding pattern is advantageously arranged as a plurality of symbols in a matrix, each symbol defining a binary digit for each of two directions. A
5 part of a predetermined size of the matrix unambiguously defines a coordinate.

The printer is preferably adapted to identify a predetermined number of symbols in the recorded image, to
10 separate the position-coding pattern in the image into a first position code for a first coordinate and a second position code for a second coordinate by translating each symbol into at least one digit for the first position code and at least one digit for the second position code, and to calculate the first coordinate by means of the
15 first position code and the second coordinate by means of the second position code.

Preferably, the printing means are arranged adjacent to the image sensor at one end of the printer. A recorded position determined by means of the image sensor then
20 conforms with the position of the printing means.

The printer is preferably adapted to determine the speed and direction of the printing means in relation to the surface by means of at least two recorded positions converted from at least two recorded images. This makes
25 it possible to take the movement of the printing means into consideration when printing.

The printer is advantageously adapted to calculate the predicted position starting from the last recorded position and the speed and direction of the printing
30 means.

The printer is advantageously adapted to print only if the speed of the printing means in relation to the surface is essentially constant. When the printing means has a retarding or accelerating movement in relation to
35 the surface, it is difficult to calculate the predicted position. This means an increased probability for an error to occur in the printing process.

The printer is preferably handheld although it is within the scope of the invention that the printer is not handheld. The great advantage of the invention is, however, that it is possible to make the printer extremely small and advantageously handheld. In the case where the printer is not handheld, the printing means and the image sensor are movably arranged in relation to a stationary part of the printer.

The image sensor has advantageously a main viewing direction in which it is adapted to collect radiation from the surface, the printer being adapted to determine its turning position in relation to the viewing direction by means of the recorded image and to print with the aid of the turning position.

By the printer determining its turning position, it will be possible to take into account the fact that the printing means are not centred in relation to the image sensor.

According to a preferred embodiment of the invention, the image sensor thus records an image taken in a direction relative to the image sensor.

According to an embodiment of the invention, the printing means are adapted to print in a plurality of points at the same time. As a result, the printing speed increases.

According to one aspect, the invention provides a system for printing graphic information, comprising a printer and a base. The system is characterised in that the base has a position-coding pattern which codes the absolute coordinates for a plurality of positions on the base, and the printer comprises printing means for printing on the base, and further comprises an image sensor for recording an image of the base, the printer being adapted to print on the base with the aid of the position-coding pattern in the recorded image and the graphic information.

According to one aspect, the invention provides a

method for printing stored graphic information on a surface. The method is characterised by the steps of recording an image of a surface, and print on the surface with the aid of the recorded image and the stored graphic
5 information.

According to one aspect, the invention provides a printer which comprises a heating means for heating a base in order to change its colour. The printer according to this aspect of the invention is characterised in that
10 it further comprises an image sensor for recording an image of the surface, the printer being adapted to heat the base, so that its colour changes, with the aid of the recorded image.

According to this aspect of the invention, the heating step preferably consists of a spark gap. When a spark
15 is generated in the spark gap, the sheet of paper is heated locally at the spark gap. The sheet is heated in points corresponding to graphic information that is to be printed.

20 Another method of generating a changed colour is to expose the paper for a laser beam.

The above features can, of course, be combined in the same embodiment.

In order to further illustrate the invention,
25 detailed embodiments of the invention will be described below, without however the invention being considered to be restricted thereto.

The accompanying drawings are only schematic and, thus, certain dimensions are greatly exaggerated for
30 the purpose of elucidating the invention.

Brief Description of the Drawings

Fig. 1 illustrates a printer according to a preferred embodiment of the present invention.

Fig. 2 illustrates a sheet of paper with a pattern
35 adapted to the printer according to the present invention.

Fig. 3 shows an example of a symbol which can be

used in connection with a printer according to the invention.

Fig. 4 shows how a pattern according to the present invention is converted into a recorded position in the form of two coordinates.

Fig. 5 illustrates how an image is composed when using a printer according to the present invention.

Detailed Description of the Invention

Fig. 1 shows a printer according to a preferred embodiment of the present invention. The printer 1 comprises a nozzle in the form of an inkjet head 2 for dispensing ink on a surface, an image sensor 3 in the form of a CCD for recording an image of the surface, and a diode 4 for illuminating the surface. In front of the CCD there is a lens system 8 which is intended for imaging the coding pattern on the CCD. The printer 1 also comprises an image-processing means 5 for processing the image recorded by the image sensor 3, and a battery 6 which constitutes the power supply for the printer. A communication unit 7 is intended for communication between the printer and a computer. The image-processing means 5 consists of a microcomputer and comprises a memory 9 for storage of graphic information. The printer has buttons 10 for operating the printer 1 and a display 11 for presenting information. The information presented on the display is, for instance, the text that is to be printed on the sheet of paper. The printer 1 is adapted to be held by the user's hand and to be passed over a surface which has a position-coding pattern. The printer has a main viewing direction 50 which is the direction in which images are recorded. Since the viewing direction 50 does not extend through the inkjet head, it must be taken into consideration how the pen is turned when ink is being dispensed.

According to an alternative embodiment, the printer has a plurality of nozzles 2 so that ink can be dispensed to a plurality of points simultaneously.

The printer is advantageously arranged to indicate when a printing is complete. This indication may be presented on the display 11, or with a separate indication lamp 51.

5 Fig. 2 shows a sheet of paper, which is included in a system according to a preferred embodiment of the present invention and which the printer is adapted to record. The surface of the sheet of paper 12 is provided with a position-coding pattern 13. Fig. 2 is an enlarge-
10 ment of a small part of the position-coding pattern on the surface of the sheet of paper, which pattern consists of a plurality of symbols arranged in a matrix. In Fig. 2, also the area 16 which is recorded by the printer is marked. The printer can determine a position by means
15 of the recorded image of the position-coding pattern.

The position-coding pattern with which the printer is intended to be used can be of the type disclosed in US 5,852,434, where each position is coded by a specific symbol.

20 The position-coding pattern is, however, advantageously of the type disclosed in Applicant's PCT applications WO 00/73983 and PCT/SE00/01895 and WO 01/16691, the contents of which are hereby included in this application by reference, where each position is coded by
25 a plurality of symbols and each symbol contributes to the coding of a plurality of positions.

The position-coding pattern is built up of a small number of types of symbols. An example is disclosed in WO 00/73983 where a large dot represents a "one" and a small
30 dot represents a "zero". Another example is disclosed in PCT/SE00/01895, where four different displacements of a dot in relation to a raster point code four different values.

Figs 3a-d show a symbol which can be used for coding
35 positions in the position-coding pattern on the sheet of paper in Fig. 2 according to a preferred embodiment of the invention. The symbol comprises a virtual raster

point 14, which is represented by the intersection between the raster lines, and a mark 15 which has the form of a point. The value of the symbol depends on where the mark is located. In the example in Fig. 3, there are
5 four possible locations, one on each of the raster lines extending from the raster points. The displacement from the raster point is equal to all values. The symbol has in Fig. 3a the value "0", in Fig. 3b the value "1", in Fig. 3c the value "2" and in Fig. 3d the value "3". In
10 other words, there are four different types of symbols. Each symbol can thus represent one of four different values "0-3".

Fig. 4 illustrates the appearance of a sequence 17 which is used in the position-coding pattern according to a preferred embodiment of the invention. The sequence
15 17 comprises 512 values 18 each of which is either "0", "1", "2" or "3". An arbitrary subsequence 19, 20 with 5 values unambiguously defines a sequence value corresponding to the position of the subsequence in the sequence
20 17. Each subsequence occurs in the sequence only once. Thus the first subsequence 19 corresponds to the value "0" and the second subsequence 20 to the value "1". In Fig. 2, the columns and rows in the matrix consist of sequences in which the values have been converted into
25 symbols. Sequences of this kind are described in "Pseudo-Random Sequences and Arrays" by F. Jessie MacWilliams and Neil J.A. Sloane in "Proceedings of the IEEE" Vol. 64, No. 12, December 1976.

Fig. 5 shows a part of the position-coding pattern
30 which is reproduced on the sheet of paper 12 in Fig. 2. A first matrix 30 in Fig. 5a is the smallest matrix which unambiguously defines a position. The position-coding pattern 13 is made up of symbols 31 like those shown in Fig. 3. In the position-coding pattern, use is made of
35 the four different values to code a binary bit in each of two orthogonal directions. Thus, the four different values "0, 1, 2, 3" code the four different bit combina-

tions (0, 0), (0, 1), (1, 0), (1, 1), where the first digit in each bit combination relates to a first direction and a second digit relates to a second direction which is orthogonal to the first direction. When the printer records the first matrix 30 in Fig. 3, it is converted to a second matrix 32 with values 33, which defines the x coordinate, and to a third matrix 34 with values 35, which defines the y coordinate, by means of the above-mentioned relationship between values and bit combinations. The second matrix 32 contains subsequences 36 which constitute columns in the second matrix. The values in the matrix are either "0" or "1". The subsequences are a part of the sequence which has been described above in connection with Fig. 3. Each subsequence thus has a unique sequence value. The five subsequences in the columns in the second matrix 32 are converted to five sequence values Sx_1, Sx_2, Sx_3, Sx_4 and Sx_5 which define the x coordinate. Similarly, subsequences 37 with values 35 are arranged in rows in the third matrix. These subsequences are also parts of the sequence in Fig. 4 and are similarly converted to a second set Sy_1-Sy_5 which defines the position of the different subsequences in the sequence. Subsequently the difference between adjacent sequence values is calculated, which gives rise to two sets of four difference values Dx_1-Dx_4 and Dy_1-Dy_4 , respectively, $Dx_n = Sx_{n+1} - Sx_n$ modulo R and $Dy_n = Sy_{n+1} - Sy_n$ modulo R, where R is the number of unique subsequences in the sequence in Fig. 4. Then the difference values are used to generate an x coordinate and a y coordinate.

The conversion from difference values to coordinates can be carried out in many different ways. According to one embodiment, the subsequences are arranged in such manner that one of the difference values in each matrix which unambiguously defines a position has an integer value in the range "0-3". This codes the most significant digit. The subsequences are also arranged so that

the x coordinate will be one unit greater when moving one column in the matrix and so that the y coordinate will be one unit greater when moving one row in the matrix. Since the columns in the second matrix in Fig. 5b consist of parts of the sequence in Fig. 4, each of the sequence values in the two columns Sx_1 and Sx_2 furthest to the left in the matrix in Fig. 5b will be one unit greater when moving down one row in the matrix 32. However, Dx_1 remains constant. Consequently, also the x coordinate remains constant when moving downwards in the second matrix 32.

Fig. 6 illustrates how a printout is built up as the printer operates. The printer records images of the base and converts them into positions as described above in connection with Fig. 5. As the printer is being passed over the sheet of paper, images of the position-coding pattern are continuously recorded and converted into positions. In Fig. 6a, a first position 40 and a second position 41 are marked. The image-processing means is adapted to calculate a predicted position 42 by means of the first position 40 and the second position 41, by also the interval between the recording of the two images being known. The predicted position 42 is compared with graphics positions which are stored in the memory 9. Since the predicted position 42 conforms with a graphics position which is stored in the memory, ink is dispensed from the inkjet head 2. In the same manner, dispensing of ink from the inkjet head is initiated at all other times when conformity is obtained between the predicted position and a graphics position. The interval between the time of the recording of the image which corresponds to the second position and the time when the inkjet head is in the predicted position is used by the printer to convert the recorded image into a position, to calculate a predicted position, to compare the predicted position 42 with the graphic information and to dispense ink. When the predicted position is calculated, the speed and

direction of the printer are thus taken into consideration. As the printer is being passed over the surface, the entire image will thus be built up. This is illustrated in Figs 6a-6d. Since the inkjet head is not
5 centred relative to the image sensor in the printer which is shown in Fig. 1, it is necessary to determine how the printer is turned for ink to be dispensed in the correct position. This is carried out by the image-processing means with the aid of the recorded image.

10 The graphic information thus consists, as mentioned above, of a number of graphics positions corresponding to the image which is to be printed. Each point corresponds to a minimum point which is printed with the inkjet head. The graphic information corresponds to an image or text
15 which is to be printed. The graphics positions which define the graphic information can be in an arbitrary position. The only relevant matter is that their mutual location is such that they define the graphic information. The position-coding pattern possibly codes positions within a completely different area than that in
20 which the graphics positions are located.

Fig. 7 illustrates how it is taken into consideration that the position-coding pattern codes other positions than those present in the graphic information. When
25 a user initiates that the graphic information is to be printed, a first image of a position-coding pattern is recorded on a sheet of paper 44, which image is converted into a start position 43. The start position 43 defines where a user wants the graphic information to be printed.
30 The graphic information 45 consists of graphics positions which define an "A". The graphics positions have no positions in common with the position-coding pattern on the sheet of paper 44. The graphics positions are transformed so that a median graphics position 46 will be
35 located in the start position 43. As the printer is then being passed over the sheet of paper, the graphic information is printed in the form of an "A" 47.

According to an alternative embodiment, use is made of the property that the graphics positions do not coincide with the position-coding pattern. It is then necessary to have access to a sheet of paper with a position-coding pattern which codes precisely the graphics positions which are present in the graphic information to allow it to be printed. The graphic information can be, for example, handwritten text recorded by means of another position-coding pattern than the one used in the printing of the information.

The conversion of text or images can be carried out in a number of ways which can easily be accomplished by a person skilled in the art and will therefore not be described in detail.

According to an alternative embodiment of the printer, the nozzle 2 of the printer is replaced with a ball point 52, as shown in fig 8a, which is arranged to be moved to the paper when ink is to be dispensed on the surface.

According to another embodiment of the printer, the nozzle 2 of the printer is replaced with a point 53, as shown in fig 8b, and the surface is the surface of a pressure sensitive paper. Pressure sensitive papers are known from the art and are such that they are blackened when a pressure is applied to them. According to this embodiment of the invention the point is arranged to apply a pressure to the paper in positions which correspond to graphics positions in the graphical information.

According to still another embodiment of the printer, the nozzle 2 of the printer is replaced with a magnetic point 54, as shown in fig 8c, and the surface which is used is a magnetic paper. Magnetic papers comprise small permanent magnets, which give a certain colour to the paper depending on their orientation in relation to the surface of the paper. According to this embodiment the point is arranged to be that close to the

surface of the paper in positions corresponding to the graphical positions so that the magnetic force becomes large enough for the permanent magnets in these positions to turn so that a printing is obtained.

5 The embodiments described above are to be considered as examples only.

 A person skilled in the art appreciates that the above embodiments can be varied in many ways without departing from the inventive concept. For instance, it is
10 possible to use some other type of symbols in the position-coding pattern. Different values can, for instance, be coded with filled circles of different size.

CLAIMS

1. A printer comprising means (2) for printing on a
5 surface and an image sensor (3) for recording an image of
the surface, said printer (1) being adapted to print on
the surface with the aid of the recorded image and gra-
phic information that is to be printed, c h a r a c t -
e r i s e d in that it is adapted to convert the recorded
10 image into at least one recorded position in the form of
two coordinates, in response to the recorded image con-
taining a position-coding pattern (13) coding at least
one position.

2. A printer comprising a nozzle (2) for dispensing
15 dye on a surface and an image sensor (3) for recording an
image of the surface, said printer (1) being adapted to
dispense the dye on the surface with the aid of the
recorded image and graphic information that is to be
printed, c h a r a c t e r i s e d in that it is adapted
20 to convert the recorded image into at least one recorded
position in the form of two coordinates, in response to
the recorded image containing a position-coding pattern
(13) coding at least one position.

3. A printer as claimed in claim 1, c h a r a c -
25 t e r i s e d in that it further comprises a memory (9)
for storing the graphic information in the form of a
plurality of graphics positions.

4. A printer as claimed in claim 3, c h a r a c -
t e r i s e d in that it is adapted to convert text and
30 images, which are received by the printer to be printed,
into said plurality of graphics positions.

5. A printer as claimed in claim 1, 3 or 4,
c h a r a c t e r i s e d in that it is adapted to trans-
form the graphics positions in the graphic information in
35 response to an input signal containing information about
a transformation.

6. A printer as claimed in claim 5, c h a r a c -
t e r i s e d in that the transformation is carried out
with the aid of said at least one recorded position as
the input signal, so that one of the graphics positions
5 essentially conforms with a position in the position-
coding pattern.

7. A printer as claimed in any one of claims 1 or 3-
6, c h a r a c t e r i s e d in that it is adapted to
print on the surface when the recorded position conforms
10 with a graphics position in the graphic information.

8. A printer as claimed in any one of claims 1 or 3-
6, c h a r a c t e r i s e d in that it is adapted to
determine a predicted position of the printing means (2)
by means of the recorded position, and to print when the
15 predicted position conforms with a graphics position in
the graphic information.

9. A printer as claimed in claim 8, c h a r a c -
t e r i s e d in that the printer is adapted
to determine the speed and direction of the print-
20 ing means (2) in relation to the surface by means of at
least two recorded positions converted from at least two
recorded images, and

to calculate the predicted position starting from
one of the recorded positions as well as the speed and
25 direction of the printing means (2).

10. A printer as claimed in any one of claims 1 or
3-9, c h a r a c t e r i s e d in that it is adapted to
determine the speed and direction of the printing means
(2) in relation to the surface by means of at least two
30 recorded positions converted from at least two recorded
images.

11. A printer as claimed in any one of claims 1 or
3-10, c h a r a c t e r i s e d in that it is adapted
to identify a predetermined number of symbols (15,
35 31) in the position-coding pattern (30) in the recorded
image, and

to separate the position-coding pattern (30) in the image into a first position code (32) for a first coordinate and a second position code (34) for a second coordinate by translating each symbol into at least one digit for the first position code and at least one digit for the second position code, and

to calculate the first coordinate by means of the first position code and the second coordinate by means of the second position code.

10 12. A printer as claimed in any one of claims 1 or 3-11, characterised in that it is handheld.

13. A printer as claimed in any one of claims 1 or 3-12, characterised in that the image sensor (3) has a main viewing direction (50) in which it is adapted to record radiation from the surface, the printer being adapted to determine its turning position in relation to the viewing direction (50) by means of the recorded image, and to print with the aid of the turning position.

20 14. A printer as claimed in any one of claims 1 or 3-13, characterised in that the printing means (2) are adapted to print in a plurality of directions.

25 15. A printer as claimed in any one of claims 1 or 3-14 characterised in that the printing means are a nozzle for dispensing dye on a surface.

16. A system for printing graphic information, comprising a printer (1) and a base (12), characterised in that

30 the base (12) has a position-coding pattern (13, 30) which is designed so that an arbitrary subset of the position-coding pattern (13, 30), said subset having a predetermined size, codes the absolute coordinates for a position on the base (12), and

35 the printer (1) comprises printing means (2) for printing on a base (12), and further comprises an image sensor (3) for recording an image of the base (12), the

printer (1) being adapted to print on the base (12) with the aid of the position-coding pattern in the recorded image (16) and the graphic information.

17. A method for printing stored graphic information
5 on a surface, characterised by the steps of
recording an image of a surface, and
printing on the surface with the aid of the recorded image and the stored graphic information.

18. A printer comprising a nozzle (2) for dispensing
10 dye on a surface and an image sensor (3) for recording an image of the surface, said printer (1) being adapted to dispense the dye on the surface with the aid of the recorded image and graphic information that is to be printed, characterised in that it is adapted
15 to convert the recorded image into at least one recorded position in the form of two coordinates, in response to the recorded image containing a position-coding pattern (13) coding at least one position, and that it is further adapted to determine a predicted position of the nozzle
20 (2) by means of the recorded position, and to dispense the dye when the predicted position conforms with a graphics position in the graphic information.

19. A printer comprising means (2) for printing on a surface and an image sensor (3) for recording an image of
25 the surface, said printer (1) being adapted to print on the surface with the aid of the recorded image and graphic information that is to be printed, characterised in that it is adapted to convert the recorded image into at least one recorded position in
30 the form of two coordinates, in response to the recorded image containing a position-coding pattern (13) coding at least one position, and that it is further adapted to determine a predicted position of the nozzle (2) by means of the recorded position, and to print when the predicted
35 position conforms with a graphics position in the graphic information.

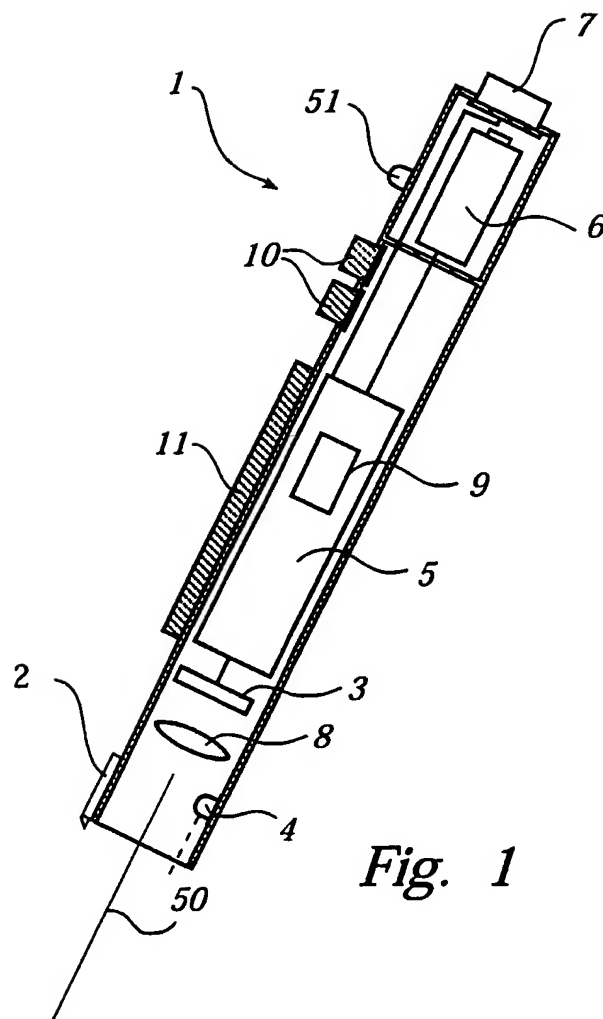
20. A system for printing graphic information, comprising a printer (1) and a base (12), characterised in that

the base (12) has a position-coding pattern (13, 30) which is designed so that an arbitrary subset of the position-coding pattern (13, 30), said subset having a predetermined size, codes the absolute coordinates for a position on the base (12), and

the printer (1) comprises printing means (2) for printing on a base (12), and further comprises an image sensor (3) for recording an image of the base (12), the printer (1) being adapted to print on the base (12) with the aid of the position-coding pattern in the recorded image (16) and the graphic information.

21. A method for printing stored graphic information on a surface, characterised by the steps of recording an image of a surface, and printing on the surface with the aid of the recorded image and the stored graphic information.

1/6



2/6

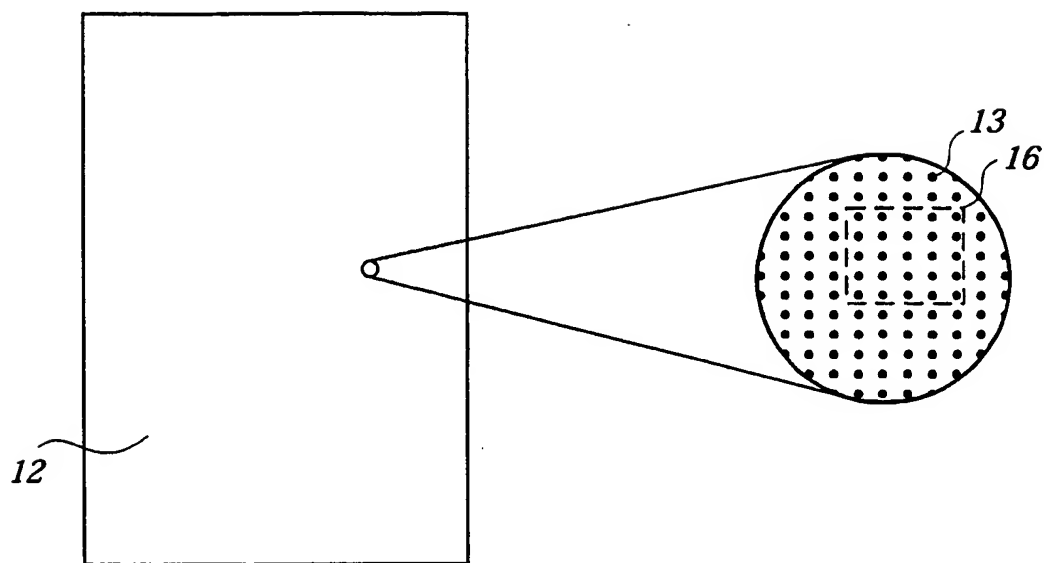


Fig. 2

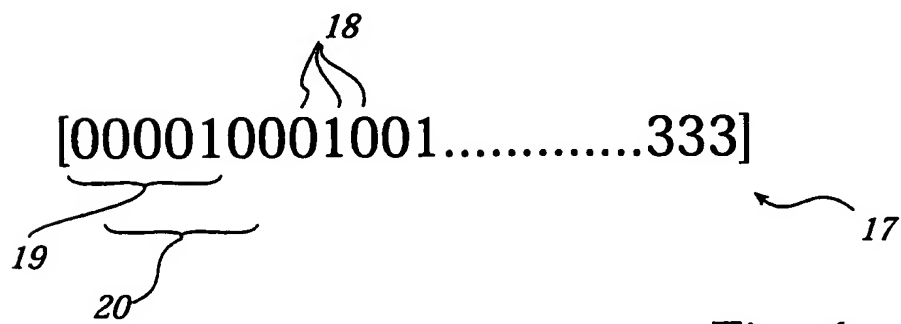
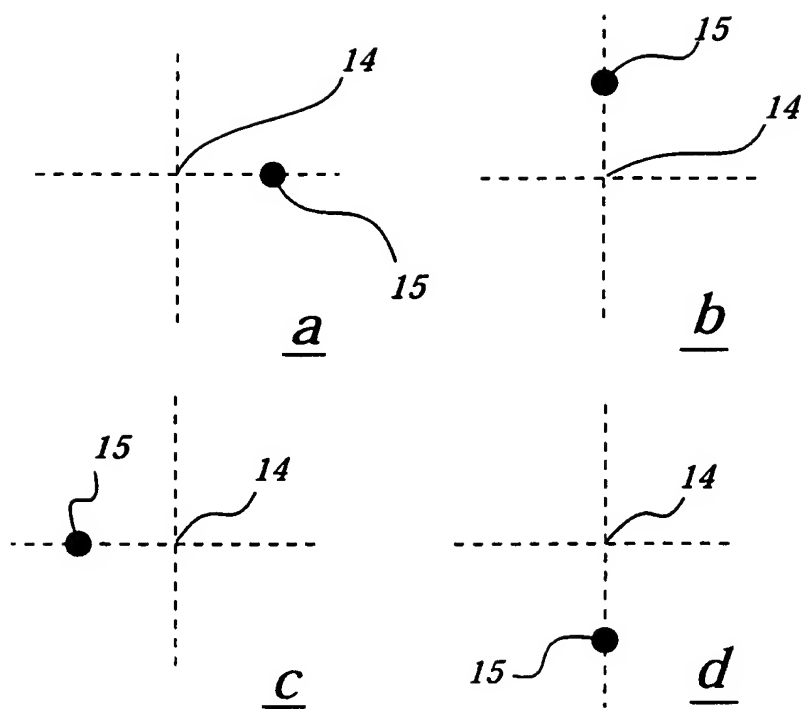
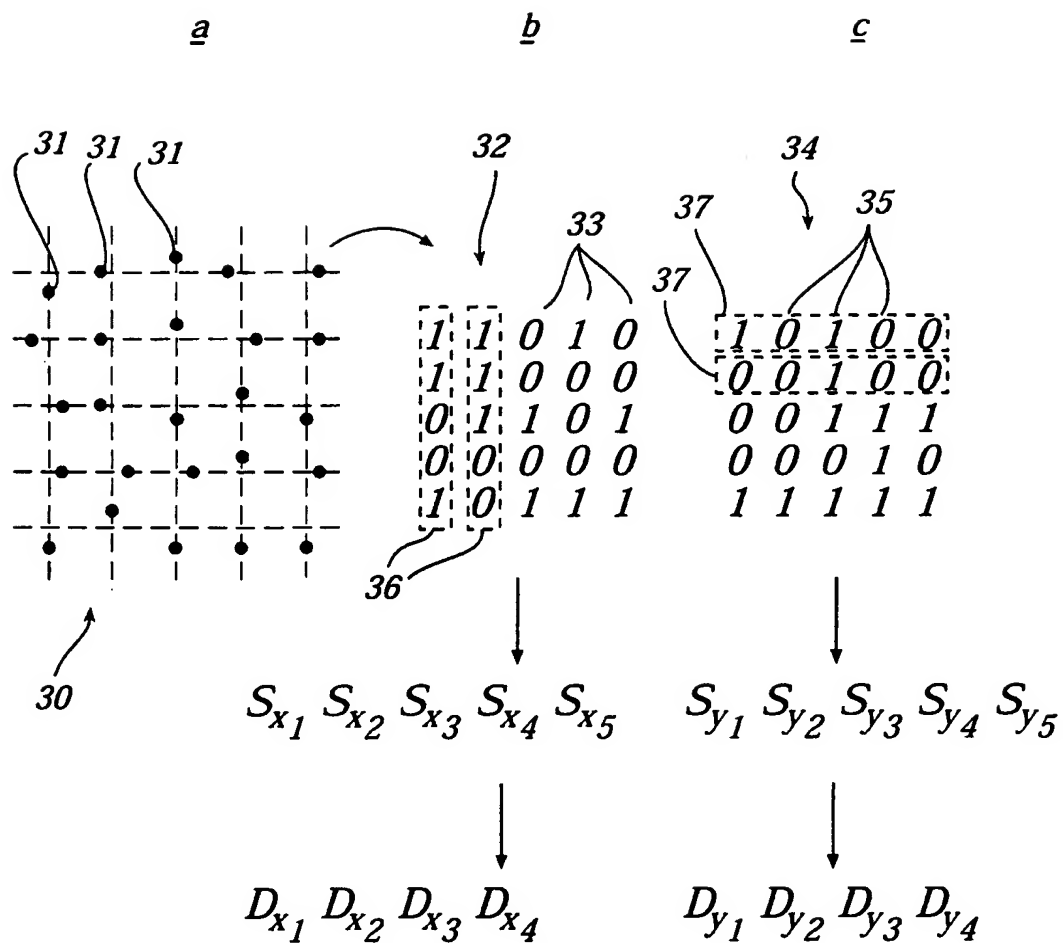


Fig. 4

3/6

*Fig. 3*

4/6

*Fig. 5*

5/6

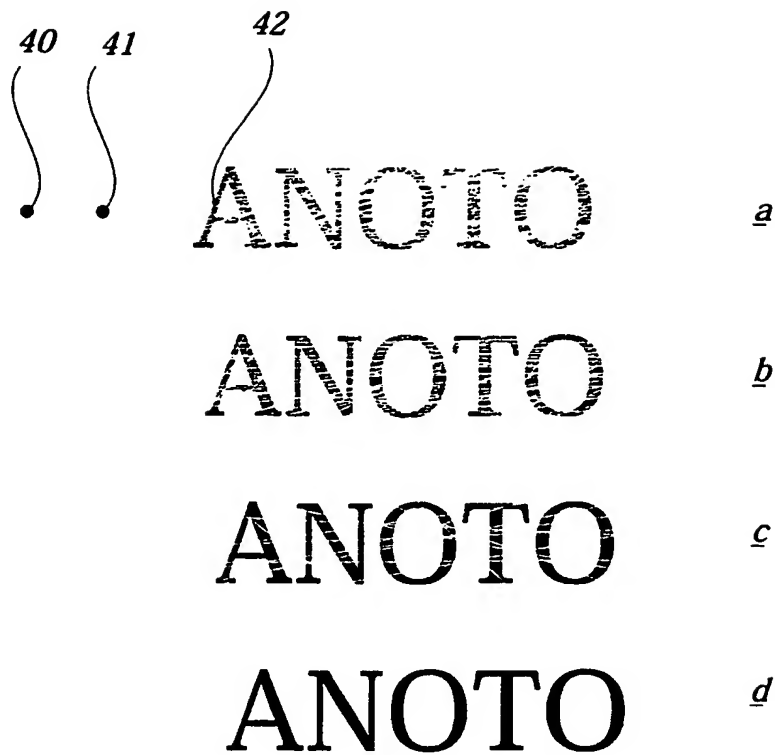


Fig. 6

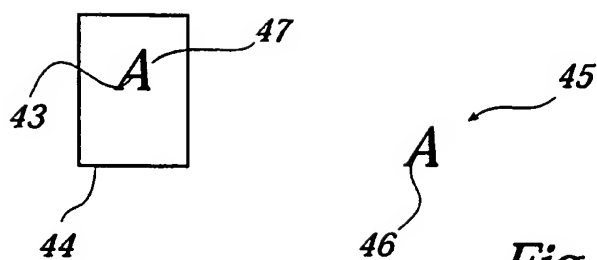


Fig. 7

6/6

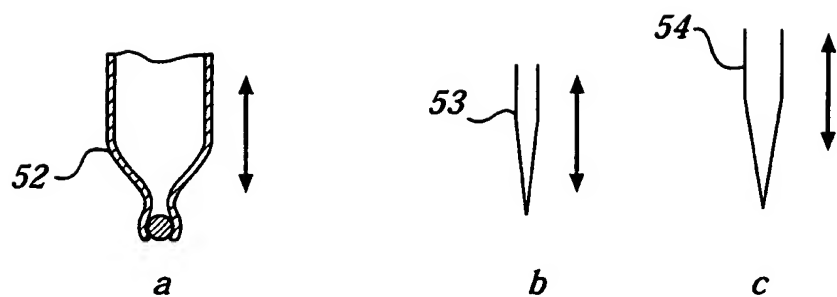


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/00595

A. CLASSIFICATION OF SUBJECT MATTER		
IPC7: B41J 3/36 // B41J 2/00, H04N 1/00 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC7: H04N, G06K, B41J		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI DATA, EPO-INTERNAL		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5927872 A (NORIHIDE YAMADA), 27 July 1999 (27.07.99), column 7, line 33 - line 67; column 5, line 13 - line 17, abstract --	1-21
Y	US 5852434 A (ORAL F. SEKENDUR), 22 December 1998 (22.12.98), column 5, line 22 - line 39, see the whole document --	1-15,17-19, 21
A	--	16,20
A	US 5825995 A (CHRISTOPHER A. WIKLOF ET AL), 20 October 1998 (20.10.98) --	1-21
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
9 July 2001		11 -07- 2001
Name and mailing address of the ISA: Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer HENRIK ANDERSSON/EE Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/00595

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	WO 0029218 A2 (ESSELTE N.V.), 25 May 2000 (25.05.00) -- -----	1-21

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/07/01

International application No.
PCT/SE 01/00595

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
US	5927872	A	27/07/99	JP	11058844 A	02/03/99
US	5852434	A	22/12/98	AU	4529896 A	14/07/97
				US	5477012 A	19/12/95
				WO	9722959 A	26/06/97
US	5825995	A	20/10/98	JP	10029346 A	03/02/98
WO	0029218	A2	25/05/00	AU	6357999 A	05/06/00
				GB	0108469 D	00/00/00
				GB	2343657 A	17/05/00
				GB	9825021 D	00/00/00